22429

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Assume suitable data, if necessary.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

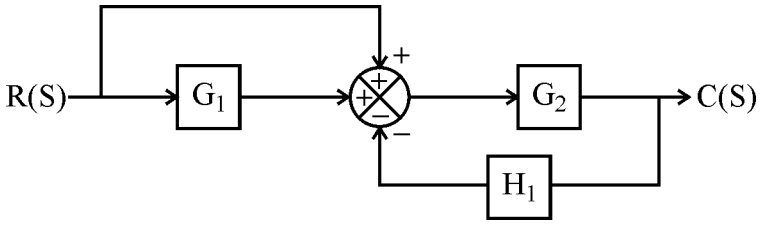
(a) Define order of the system and write one example of first order system.

(b) List any four rule of block diagram reduction technique.

(c) Find poles and zeroes of the system with transfer function as

$$\text{T.F.} = \frac{40(S+2)}{S(S+1)(S+4)}$$

(d) Find closed loop transfer function of the following system.



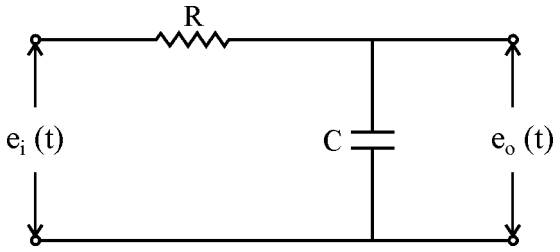
(e) Define closed loop transfer function. State the importance of transfer function.

(f) Write the name different composite controllers.

(g) State Routh's stability criterion.

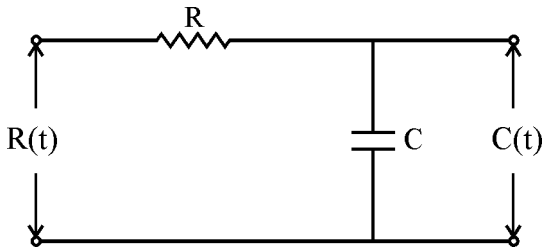
2. Attempt any THREE : **12**

(a) Find the transfer function of the following RC circuit :



(b) Draw block diagram of process control system and write the need for the controller.

(c) Obtain the response of system shown in fig. for unit step input.



(d) Obtain the Laplace transform of the function – (i) 1 (ii) e^{-at}

3. Attempt any THREE : **12**

(a) Obtain the stability of the system whose transfer function is given below using pole-zero method.

$$G(S) = \frac{10(S+1)}{(S+2)(S^2+2S+2)}$$

(b) For unity feedback system the transfer function is given by

$$\frac{C(S)}{R(S)} = \frac{25}{S^2+6S+25}$$

Find :

(i) Peak time

(ii) Peak overshoot

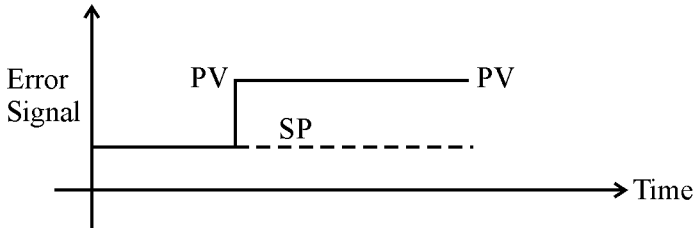
(c) Derive the expression of transfer function of closed loop control system in terms of open loop transfer function.

(d) Draw and define different standard test input signals and also write its Laplace transform.

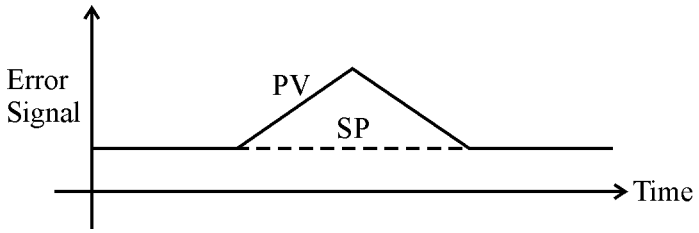
4. Attempt any THREE : **12**

(a) Compare PI and PD controllers (any four point).

(b) (i) Draw responses of P, I, D controllers for the following input :



(ii) Draw the PID controller response for the following input :



(c) Explain ON-OFF controller with suitable diagram.

(d) Explain DC servo system with schematic diagram.

(e) Explain with sketch the working of the variable reluctance type stepper motor.

5. Attempt any TWO : **12**

(a) Draw circuit diagram of electronic Op-Amp based PID controller. Write its output expression. Write one advantage of P, I & D controller.

(b) A unity feedback system has

$$G(S) = \frac{40(S+2)}{S(S+1)(S+4)}$$

Determine all error coefficient.

(c) List servo component required for controlling the position of the object through 0° to 360° and draw schematic diagram.

6. Attempt any TWO : **12**

(a) For servo mechanism represented by $\frac{d^2\theta(t)}{dt^2} + 10\frac{d\theta(t)}{dt} - 150\, e(t) = 0$

Where e(t) is error signal calculate

(i) E_1

(ii) W_n

(iii) W_d

(b) The unity feedback system is characterised by open loop transfer function

$$G(S) = \frac{K(S+13)}{S(S+3)(S+7)}$$

Using Routh's criteria calculate range of K for system to be stable.

(c) Draw the bode plot and calculate gain margin and phase margin for the following control system.